

L Number	Hits	Search Text	DB	Time stamp
2	1	6789039.pn. and point and light	USPAT	2004/11/03 13:43
3	1	6789039.pn.	USPAT	2004/11/03 13:43
4	18	("4381608"   "4490849"   "4631598"   "4639878"   "4653104"   "4945493"   "5699444"   "5764516"   "5832106"   "5870490"   "5933921"   "6009189"   "6101268"   "6101455"   "6138196"   "6219063"   "6249234"   "6359647").PN.	USPAT	2004/11/03 13:46
5	0	6789039.URPN.	USPAT	2004/11/03 13:43
6	0	("4381608"   "4490849"   "4631598"   "4639878"   "4653104"   "4945493"   "5699444"   "5764516"   "5832106"   "5870490"   "5933921"   "6009189"   "6101268"   "6101455"   "6138196"   "6219063"   "6249234"   "6359647").PN. and (((moving or movement or displacing or displacement or motion) near4 (point or focus or spot or dot) near4 (light or laser or ray or beam)) with (((flat or plane or planar) near3 (surface or extent or expanse)) or (floor or wall or ceiling)))	USPAT	2004/11/03 13:52
7	0	("4381608"   "4490849"   "4631598"   "4639878"   "4653104"   "4945493"   "5699444"   "5764516"   "5832106"   "5870490"   "5933921"   "6009189"   "6101268"   "6101455"   "6138196"   "6219063"   "6249234"   "6359647").PN. and ((moving or movement or displacing or displacement or motion) near4 (point or focus or spot or dot) near4 (light or laser or ray or beam)) and (((flat or plane or planar) near3 (surface or extent or expanse)) or (floor or wall or ceiling)))	USPAT	2004/11/03 13:53
8	0	("4381608"   "4490849"   "4631598"   "4639878"   "4653104"   "4945493"   "5699444"   "5764516"   "5832106"   "5870490"   "5933921"   "6009189"   "6101268"   "6101455"   "6138196"   "6219063"   "6249234"   "6359647").PN. and ((moving or movement or displacing or displacement or motion) near4 (point or focus or spot or dot) near4 (light or laser or ray or beam))	USPAT	2004/11/03 13:54
9	300	((calibrat\$3 or modif\$7 or adjust\$4 or alter\$5) near3 (camera or imager or (photo\$detector or (imaging adj (device or apparata or apparatus)))) and ((moving or movement or displacing or displacement or motion) near4 (point or focus or spot or dot) near4 (light or laser or ray or beam))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 14:00
10	102	((calibrat\$3 or modif\$7 or adjust\$4 or alter\$5) near3 (camera or imager or (photo\$detector or (imaging adj (device or apparata or apparatus)))) and ((moving or movement or displacing or displacement or motion) near4 (point or focus or spot or dot) near4 (light or laser or ray or beam)) and (relat\$3 near3 (camera or imager or (photo\$detector or (imaging adj (device or apparata or apparatus)) near3 (position or location or orientation or placement))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 14:06
-	189	73/1.01.ccls.	USPAT; US-PGPUB	2004/11/02 09:45
-	103	73/1.75.ccls.	USPAT; US-PGPUB	2004/11/02 09:45
-	220	73/1.79.ccls.	USPAT; US-PGPUB	2004/11/02 09:45
-	367	348/135.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	536	356/614.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	293	382/286.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	244	382/289.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	102	702/1.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	244	702/33.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	113	702/40.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	411	702/85.ccls.	USPAT; US-PGPUB	2004/11/02 09:46
-	311	702/94.ccls.	USPAT; US-PGPUB	2004/11/02 09:47

-	191	702/95.ccls.	USPAT; US-PGPUB	2004/11/02 09:47
-	122	702/105.ccls.	USPAT; US-PGPUB	2004/11/02 09:47
-	256	702/127.ccls.	USPAT; US-PGPUB	2004/11/02 09:47
-	648	702/150.ccls.	USPAT; US-PGPUB	2004/11/02 09:47
-	257	702/151.ccls.	USPAT; US-PGPUB	2004/11/02 09:47
-	211	702/152.ccls.	USPAT; US-PGPUB	2004/11/02 09:47
-	173	702/153.ccls.	USPAT; US-PGPUB	2004/11/02 09:48
-	0	702/85.ccls. and 73.101.ccls.	USPAT; US-PGPUB	2004/11/02 09:48
-	0	702/85.ccls. and 73.175.ccls.	USPAT; US-PGPUB	2004/11/02 09:49
-	0	702/85.ccls. and 73.179.ccls.	USPAT; US-PGPUB	2004/11/02 09:49
-	0	702/85.ccls. and 356/614.ccls.	USPAT; US-PGPUB	2004/11/02 09:49
-	0	702/85.ccls. and 382/286.ccls.	USPAT; US-PGPUB	2004/11/02 09:49
-	0	702/85.ccls. and 382/289.ccls.	USPAT; US-PGPUB	2004/11/02 09:49
-	0	702/85.ccls. and 702/40.ccls.	USPAT; US-PGPUB	2004/11/02 09:50
-	0	702/85.ccls. and 702/152.ccls.	USPAT; US-PGPUB	2004/11/02 09:50
-	1	702/85.ccls. and 348/135.ccls.	USPAT; US-PGPUB	2004/11/02 09:50
-	2	702/85.ccls. and 702/1.ccls.	USPAT; US-PGPUB	2004/11/02 09:51
-	4	702/85.ccls. and 702/33.ccls.	USPAT; US-PGPUB	2004/11/02 09:51
-	14	702/85.ccls. and 702/94.ccls.	USPAT; US-PGPUB	2004/11/02 09:53
-	5	702/85.ccls. and 702/95.ccls.	USPAT; US-PGPUB	2004/11/02 09:56
-	6	702/85.ccls. and 702/105.ccls.	USPAT; US-PGPUB	2004/11/02 09:56
-	5	702/85.ccls. and 702/127.ccls.	USPAT; US-PGPUB	2004/11/02 09:56
-	10	702/85.ccls. and 702/150.ccls.	USPAT; US-PGPUB	2004/11/02 09:56
-	1	702/85.ccls. and 702/151.ccls.	USPAT; US-PGPUB	2004/11/02 09:57
-	1	702/85.ccls. and 702/153.ccls.	USPAT; US-PGPUB	2004/11/02 09:59
-	0	((camera or spectrograph or imager) near3 (calibrat\$3 or scal\$3)) and ((light or ray or beam) near3 (point or spot or focus)) and (frame with "field of view") and ((plural\$3 or several or multiple or some or many or group) near3 (camera or spectrograph or imager)) and (relat\$3 near3 (position or location or siting or site))	USPAT; US-PGPUB	2004/11/03 07:29
-	0	((camera or imager) near3 (calibrat\$3 or scal\$3)) and ((light or ray or beam) near5 (point or spot or focus) near5 (moving or motion or displacement)) and ((flat or planar or plane) near3 (surface or expanse)) and (frame with "field of view") and ((plural\$3 or several or multiple or some or many or group) near3 (camera or imager)) and (relat\$3 near3 (position or location))	USPAT; US-PGPUB	2004/11/02 10:13

-	0	(camera near3 calibrat\$3) and ((light or ray or beam) with (point or spot or focus) with (moving or motion or displacement) with (flat or planar or plane) with (surface or expanse)) and (frame with "field of view") and ((plural\$3 or several or multiple or some or many or group) near3 (camera or imager)) and (relat\$3 near3 (position or location)))	USPAT; US-PGPUB	2004/11/02 10:16
-	2315	camera near3 calibrat\$3	USPAT; US-PGPUB	2004/11/02 10:15
-	4	(camera near3 calibrat\$3) and ((light or ray or beam) with (point or spot or focus) with (moving or motion or displacement) with (flat or planar or plane) with (surface or expanse))	USPAT; US-PGPUB	2004/11/02 10:26
-	6	("5227985"   "5432526"   "5546327"   "5805196"   "6064423"   "6300931").PN.	USPAT	2004/11/02 10:23
-	0	6710765.URPN.	USPAT	2004/11/02 10:23
-	4357	(calibrat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:32
-	0	(calibrat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((moving or displac\$5 or position\$3 or locat\$3 or reposition\$3 or relocat\$3) near4 (light or ray or beam) near4 (point or area or region or dot or spot)) with ((on or atop or upon or across) near4 (flat or plane or planar) near4 (surface or extent or extention or expanse or expansion)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:39
-	437	(calibrat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((moving or displac\$5 or position\$3 or locat\$3 or reposition\$3 or relocat\$3) near4 (light or ray or beam) near4 (point or area or region or dot or spot))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:43
-	11	(calibrat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((moving or displac\$5 or position\$3 or locat\$3 or reposition\$3 or relocat\$3) near4 (light or ray or beam) near4 (point or area or region or dot or spot)) with ((flat or plane or planar) near4 (surface or extent or extention or expanse or expansion)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:39
-	437	(calibrat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((moving or displac\$5 or position\$3 or locat\$3 or reposition\$3 or relocat\$3) near4 (light or ray or beam) near4 (point or area or region or dot or spot or (flat adj surface)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:44
-	78	(calibrat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((moving or displac\$5 or position\$3 or locat\$3 or reposition\$3 or relocat\$3) near4 (light or ray or beam) near4 (point or area or region or dot or spot or (flat adj surface))) and ((first or primary or initial or plural or plurality or several or multiple or some or many) near3 (frame or window)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:46
-	8	(calibrat\$3 near4 (first or primary or initial or plural or plurality or several or multiple or some or many) near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((moving or displac\$5 or position\$3 or locat\$3 or reposition\$3 or relocat\$3) near4 (light or ray or beam) near4 (point or area or region or dot or spot or (flat adj surface))) and ((first or primary or initial or plural or plurality or several or multiple or some or many) near3 (frame or window)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 07:49
-	65	(calibrat\$3 near4 (first or primary or initial or plural or plurality or several or multiple or some or many) near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element)))) and ((determin\$5 or measur\$5 or analy\$4) near4 relat\$3 near4 (camera or ccd or imager or (imaging near3 (device or apparatus or appliance or module or component or element))) near4 (position or location or coordinate)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/11/03 09:34

-	3	(5829444, 5662111, "5529070").pn.	USPAT	2004/11/03 09:36
-	1	(5829444, 5662111, "5529070").pn. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3)	USPAT	2004/11/03 09:38
-	50	73/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3)	USPAT;	2004/11/03 09:39
-	563	348/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3)	US-PGPUB	2004/11/03 09:39
-	148	396/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3)	USPAT;	2004/11/03 09:39
-	107	702/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3)	US-PGPUB	2004/11/03 09:43
-	0	438/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3) and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 relat\$3 near3 (position or location or site or placement))	USPAT;	2004/11/03 12:18
-	6	438/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3)	US-PGPUB	2004/11/03 09:46
-	24	702/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3) and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 relat\$3 near3 (position or location or site or placement))	USPAT;	2004/11/03 09:49
-	6	73/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3) and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 relat\$3 near3 (position or location or site or placement))	US-PGPUB	2004/11/03 09:57
-	17	396/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3) and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 relat\$3 near3 (position or location or site or placement))	USPAT;	2004/11/03 09:58
-	86	348/\$.ccls. and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3) and ((camera or imager or (imaging adj (device or apparatus or apparata))) near3 relat\$3 near3 (position or location or site or placement))	US-PGPUB	2004/11/03 09:58
-	60	((method\$5 or process or procedure or routine or algorithm) near5 (camera or imager or (imaging adj (device or apparatus or apparata))) near3 calibrat\$3) and ((determin\$5 or measur\$5) near5 (camera or imager or (imaging adj (device or apparatus or apparata))) near3 relat\$3 near3 (position or location or site or placement))	USPAT;	2004/11/03 12:22
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#### Accession number & update

4794776, B9411-6140C-601, C9411-5260B-402; 941026.

#### Title

Geometric camera calibration: theory and experiments.

#### Author(s)

Kachi-D; Tu-X-W.

#### Author affiliation

Centre de Recherches de Royallieu, Compiègne, France.

#### Source

Proceedings of 1994 IEEE International Symposium on Industrial Electronics (ISIE'94), Santiago, Chile, 25-27 May 1994.

Sponsors: IEEE Ind. Electron. Soc., Catholic Univ. Chile, IEEE Chile Sect., Chilean Assoc. Autom. Control.

In: p.298-303, 1994.

#### ISSN

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1994.

#### Language

EN.

#### Publication type

CPP Conference Paper.

#### Treatment codes

T Theoretical or Mathematical; X Experimental.

#### Abstract

It is known from **geometric** optics that any system of lenses can be approximated by a system which realizes a perspective projection of a 3D scene onto a 2D plate. Projective geometry is an efficient tool to investigate such an image forming system. This paper treats the problem of calibrating cameras using this tool. In this work, a new formulation of calibrating a moving **camera** is presented, and is based on the absolute conic properties. The projective invariance of the absolute conic under rigid motion ensures that its image is independent of **camera** position, and depends only on the intrinsic parameters of the **camera**. The **camera calibration** is computed in two steps. First, the estimation of the coefficients of the epipolar transformation is estimated. The computation of the absolute conic image is based on the pole and polar of the conic. Then, relations between intrinsic parameters and coefficients of the absolute conic image are then deduced. Both computer-generated and real data are included in **experiments**, which illustrates how the method works. This technique is integrated in an

iterative filtering scheme. (13 refs).

**Descriptors**

calibration; cameras; computer-vision; filtering-and-prediction- theory; geometrical-optics; iterative-methods; motion-estimation.




**Keywords**


**geometric camera calibration**; **geometric** optics; projective geometry; image forming system; absolute conic properties; rigid motion; epipolar transformation; absolute conic image; real data; computer generated data; iterative filtering scheme.

**Classification codes**

B6140C (Optical information and image processing).  
B7130 (Measurement standards and **calibration**).  
B0290F (Interpolation and function approximation).  
B7230G (Image sensors).  
C5260B (Computer vision and picture processing).  
C1250 (Pattern recognition).  
C4130 (Interpolation and function approximation).

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**JNL** = Journal or Magazine   **CNF** = Conference   **STD** = Standard1 **Geometric camera calibration: theory and experiments***Kachi, D.; Tu, X.W.;*Industrial Electronics, 1994. Symposium Proceedings, ISIE '94., 1994 IEEE International Symposium on , 25-27 May 1994  
Pages:298 - 303[\[Abstract\]](#)   [\[PDF Full-Text \(320 KB\)\]](#)   **IEEE CNF**2 **CCD camera model and its physical characteristics consideration in calibration task the robotics***Tu, X.-W.; Dubuisson, B.;*Robot and Human Communication, 1992. Proceedings., IEEE International Workshop on , 1-3 Sept. 1992  
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